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ABSTRACT

The purpose of this study was to investigate the computer backgrounds of students enrolled in a teacher credential program. Specifically, this study attempted to determine if a person's computer background had any influence on attitude towards computer use, willingness to pursue further formal instruction in computer education, interest in using the computer in a classroom setting, and other factors regarding implementation. Other studies have indicated that there are significant differences between males and females in the areas of mathematics preparation and the pursuit of mathematically oriented careers--with males generally outnumbering females. Other studies have focused on the differences in computer expertise and use between the sexes. Because computers have been traditionally linked with science and mathematics, it was hypothesized that males and females would also differ in the areas of computer interest and use. Students in the educational computer technology program at California Polytechnic Institute, Pomona, were asked to complete a three-part questionnaire pertaining to microcomputer use. The first part of the questionnaire elicited information on the students' backgrounds in mathematics and computer experience; the second was designed to determine attitudes towards computer use; and the third asked students about topics they felt were important and relevant to their use of the computer as classroom teachers. Results of this study have revealed no significant differences in the areas of computer background, attitude, and topic interest between males and females. These findings indicate that the disparity that has been observed in other mathematically oriented areas may not apply to the field of computing in education. (Contains 20 references.) (Author/ALF)

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Sex differences in computer backgrounds and attitudes: a study of teachers and teacher candidates

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Abstract

The purpose of this study was to investigate the computer backgrounds of students enrolled in a teacher credential program. Specifically, this study attempted to determine if a person's computer background had any influence on attitude towards computer use, willingness to pursue further formal instruction in computer education, interest in using the computer in a classroom setting, and other factors regarding implementation. Other studies have indicated that there are significant differences between males and females in the areas of mathematics preparation and the pursuit of mathematically oriented careers--with males generally outnumbering females. Other studies have focused on the differences in computer expertise and use between the sexes. Because computers have been traditionally linked with science and mathematics, it was hypothesized that males and females would also differ in the areas of computer interest and use.

Results of this study have revealed no significant differences in the areas of computer background, attitude, and topic interest between males and females. These findings indicate that the disparity that has been observed in other mathematically oriented areas may not apply to the field of computing in education.

Importance of this Study

The United States is becoming an information oriented society (Johnson, Swoope, 1989). The computer, as a result, is becoming more intrinsically ingrained into society at all levels (McKeown, 1987). The use of this device can be seen in the areas of manufacturing, office work, medicine, space technology, robotics, artificial intelligence, and of course, education (Bitter, 1984).

Many studies have been conducted in the field of educational computing--particularly with regard to how the computer can be employed as an instructional aid. Research has shown that computer assisted instruction (CAI) can be of great benefit to the learning disabled in terms of improving performance in a variety of subject areas, building self confidence, and instilling motivation (Cohen, Torgerson and Torgerson, 1988; Malouf, 1987-88; MacArthur and Graham, 1987). The computer has also been seen as an effective tool in instructing young children. It has been demonstrated as an effective device in promoting writing skills, fine motor skills, artistic and creative ability, autonomous learning, increased visual perception, and enhanced mathematical reasoning (Swick 1989; Binswanger, 1988). With general primary and secondary aged students throughout the country, proper implementation of CAI programs has resulted in increased performance in verbal and mathematical skills, as reflected in standardized testing (Gross, 1989). As a utility, even physical education teachers have been found to make effective use of the computer in helping to manage instruction, and in keeping large amounts of data on individual students. These tasks are normally very time consuming if the computer is not available (Priest, 1987; Kelly, 1987; Hurwitz, 1985).

Finally, one of the most promising uses is in helping to prevent "At Risk" students from dropping out of school. Many different school districts nationwide have implemented a sophisticated diagnostic CAI program developed under the direction of Patrick Suppes at Stanford University. High risk students who have been placed in the classes using this program have been found to be much less likely to drop out of school. Results from one district in Pensacola Florida showed that drop-out rates were reduced to less than 1% after the implementation of computer based instruction, which contrasted with a nearly 50% drop-out rate before the system was introduced. Some of the reasons for this dramatic turn-around are tied to the way that the computer instructs. Good CAI programs give immediate feedback, individualized attention, diagnose problems in the area of reasoning, drop to lower levels of difficulty if the student is not able to solve problems at the more difficult levels, and provide random positive reinforcement (Gross, 1989). Essentially, the computer provides instruction that is non-biased and non-judgemental. Students using systems like the one developed by Suppes have demonstrated dramatic increases in their levels of scholastic achievement--sometimes advancing through several grade levels in only a few weeks. These same students are seen as being very motivated, which is a dramatic turn-around from their attitudes prior to the implementation of the computer as a tutor (Gross, 1989).

Because the computer has the potential for being so useful to educators, it seems reasonable to hope that the use of of he computer will be seen as equally beneficial to both males and females entering the profession. The concern, however, is that many studies have demonstrated significant discrepancies between males and females in fields that are mathematically oriented. Mathematics is very closely related to computer use, particularly in the areas of programming and data manipulation (Bitter, 1987). Reasons for these differences have often been attributed to differences in socialization between males and females. The literature is filled with examples of careers that are traditionally characterized as "masculine" or "feminine." If socialization is accepted as the primary reason for ob erved discrepancies in attitudes and perceived competence between males and females, then the results of this socialization can certainly be seen in the later years of educational development. A longitudinal 20 year study of American Freshman was conducted by Alexander Astin between the years 1965 and 1985. This study revealed significant differences in enrollment numbers between males and females in mathematics (both theoretical and applied), engineering, the physical sciences, and computer science (all careers which have significant mathematical orientation a d background requirements) (Astin, 1985). It would seem that females have been socialized out of these professions, which are clearly dominated by the male gender at this time.

Some of the questions that arise at this point are: 1) Are males more likely than females to use a computer?; 2) Do males have more favorable attitudes towards using computers than females?; 3) Is the computer stereo-typed as a tool for males?; and 4) Do men and women have significantly different backgrounds in the areas of computer literacy and experience? The responses to all of these questions can have serious educational implications. Given the enormous assistance that computers are capable of providing in various educational settings, it would indeed be desirable that both male and female teachers be willing to use the device in their classrooms. There is no doubt that the computer can provide benefits in the area of classroom management (word processing, spreadsheet, and database programs are all invaluable tools in handling the day to day bureaucratic chores associated with teaching), as well as being a tool which can greatly enhance the level of instruction provided to school age students. The willingness to use the computer, on the other hand, or to implement its use in the classroom, may be entirely different between males and females.

It should be mentioned that, the ability to implement the computer properly is tied to a knowledge of the computer and its capabilities. Without this knowledge, the computer and its associated software can be worse than useless.

If females are less willing to utilize the computer than their male counterparts, then it seems that a significant percentage of students in public education will be losing out on the potential benefits that this resource can provide (especially since females outnumber males in the teaching profession).

Review of the Literature

There is a natural partnership between computers and mathematics. The binary system of numbers is the basis of computing (Bitter, 1989). This is in addition to the fact that programming languages overall are very logic and math oriented--specifically following the rules of both disciplines. Mathematics has traditionally been male dominated, and there is much research on the topic to support this idea. Theories behind the reasons for this domination are numerous, and it would go beyond the scope of this paper to document all of them. However, it would be useful at this point to elaborate on some of the discrepancies between male and female attitude and performance in the field of mathematics.

Maccoby and Jacklin (1974), indicate that boys outperform girls in mathematics. Meese and Parsons (1982), indicate that there is a significant difference in terms of the numbers of men and women entering mathematically oriented fields--especially applied mathematics, like engineering, physical sciences, and computer science. This lower level of mathematical training within the gender has serious ramifications for career positions in these professional fields.

A study involving a comparison of gifted students in mathematics was conducted at Johns Hopkins University (Benbow and Stanley, 1983). Results of this study suggest significant differences in mathematical aptitude between males and females. The study involved the administration of the mathematical portion of the Scholastic Apti de Test (SAT) (which is a test normally given to high school juniors and seniors) to groups of precocious students 13 years of age and under. The number of boys and girls tested between 1980-82 was 19883 for boys, and 19937 for girls. What was significant about this study was the numerical ratio of boys to girls scoring in the upper areas for this test. The ratio of boys to girls scoring at a level of 500 was 2:1. At scores of 600, the ratio became 4.1:1. At scores of 700, the ratio was 13.4:1 (Benbow and Stanley, 1983).

Environmental hypotheses were proposed for these obse ed differences, and the Hopkins researchers subsequently conducted studies into the backgrounds of these students. No significant differences in attitudes were found to exist between males and females towards mathematics (the measures for attitudes were admittedly broad, but seemed to show no significant discrepancies). Differential amounts of course-work were also suggested to account for the observed score differences. However, it was found that students in the study appeared to have similar levels of formal training in mathematics (Benbow and Stanley, 1983).

It seems clear that males in this sample dominated the upper scores on this mathematical abilities test. Regardless of the reasons, males were clearly more successful, based on the SAT instrument.

According to a study conducted concurrently by researchers from the University of Pittsburgh and the University of Michigan, there is a significant difference between males and females in regard to their enrollments in advanced mathematical courses, and in pursuing mathematically oriented and scientific careers (Meece, Parson, 1982). Their explanation for these differences is based on a model which emphasizes social and motivational factors. A biological explanation is not ruled out, but the belief is that in order to pursue a mathematical course of study:

"Natural ability is just one of the many options weighed, and that the final decision is more likely to be a consequence of a student's perception of reality than of reality itself." (Meece and Parsons, 1982, p. 343).

The decision to enroll in math is stated as being guided by:

"Core values such as achievement needs, competency needs, sex role values, and long range plans and goals. Thus, if a girl likes math, but feels that the amount of effort it will take to do well is not worthwhile because it decreases the time she will have for more preferred activities (activities that are more consistent with her personal values), she will be less likely to continue taking math. Similarly, if a girl sex types careers involving mathematics as masculine and not in line with her sex role values, she will be less likely to value mathematics learning and less likely to continue her mathematical studies, especially if she does not expect to do well." (Meece and Parsons, 1982, p. 343).

Mathematical and scientific careers have been traditionally stereotyped as male oriented. Although the field of computer science, and indeed, the use of microcomputers is relatively new, there is a perceived link between these areas. Computers have been used by scientists as a utility for the past 40 years (McKeown, 1987). Their use in business (another male dominated profession) has been on-going for almost the same amount of time. There is research which indicates that these stereotypes may be "perpetuated" by the journals which support the use of computers.

A study conducted by Marshall and Bannon (1988), indicates that there is a bias in computer advertising from both sexual and racial standpoints. The study was conducted by reviewing advertisements in publications representing three different areas of computing: 1) systems; 2) popular computing; and 3) educational computing (Marshall and Bannon, 1988). The periodicals were Byte, Compute, and Electronic Learning respectively. Stratified random samples of advertisements containing human subjects were selected from each of the three magazines totaling 179 overall. Seventeen graduate students in education and psychology were used to code each of the advertisements. 35% of these coders were male, and 65% female. All were white. Each coder was given a one hour training session on how to interpret bias from several standpoints. At the end of the session, there was an 87% agreement among the coders when presented with the same advertisement (Marshall and Bannon, 1988).

Results of this study indicated that males were over-represented significantly (Chi-Square analyses were performed basing expected frequencies for males on 1980 U.S. Census data) in all three publications. The worst offender was the systems magazine, in which only 27% of the advertisements showed females, and about 5% showing minorities (Marshall and Bannon, 1988, p. 21). The popular computer literature was better at representing females,ales (46%), but not much better at representing minorities. the educational magazine was the most balanced of the publications, in that it included females in 79% of the advertisements, and minorities in 42% (Marshall and Bannon, 1988, p. 21). The dominant figures, however, were still white males in all of the magazines (98.92% represented in the systems, 100% in the popular, and 100% in the education advertisements) (Marshall and Bannon, 1988, p.22).

In terms of reinforcing traditional sex role stereotypes (where the female is in a subordinate--non management position, or in a sexually exploited role), again, the Education Magazine was least biased. However, all three publications demonstrated high percentages of sexual stereotypes (systems 73%, popular 76.92%, and educational 63%) (Marshall and Bannon, 1988, p. 23).

The under-representation of females and minorities suggests a lack of sensitivity to these groups in the marketplace. Even though the typical systems executive is typically white male, there are minorities within the field. The fact that stereotypes and preconceived ideas of what a computer operator "should be" or "is" may contribute to a widening of the gap between enrollments of males and females in computer courses, and similarly, between whites and minorities.

"Computer magazines that are read by adults seem to be reinforcing race and sex stereotypes. Adults reading these magazines are repeatedly provided with messages that computers are for white males and that females using computers should be in clerical or other subordinate jobs, and that females are sex objects to be used to advertise computer products. Since these messages are being reinforced over and over again, they may become so internalized that they are passed on from adult to adult in general attitudes or even employment and from adult to children in communicating expectations." (Marshall, Bannon, 1988, p. 25).

Low self esteem and expectations are already believed to be factors which contribute to the discrepancies between observed enrollments and performance in mathematics. Environmental factors may already be socializing women and minorities out of the computer field.

It is appropriate at this point to cite information concerning the perceived interest of school age students in the use of computers and computer programs. Kiesler, Sproull, and Eccles have suggested that females may be seriously handicapped in future computing environments due to strong male bias at early ages. They suggest that computer programs and games often have predominantly male oriented themes, like sports or adventure. They further cite that the computer culture tends to reinforce male biased behaviors, such as the breaking of codes, illegally pirating software, and disabling external computer systems.

In order to determine if students indeed have conditioned ideas on sexual factors involving computer use, a study was conducted on 1st, 2nd, 3rd, 7th, 9th and 12th graders (Johnsen and Swoope, 1987). Students participating in this study were questioned on how interested they would be in: 1) using a computer; 2) using a computer program with a female oriented theme; and 3) using a computer program with a male oriented theme. The results of this study indicated that there were no significant differences between males and females in the area of using the computer. However, the study indicated that the theme of the program under use had a strong influence on student interest, depending on whether they were male or female. Girls were significantly more interested in programs with feminine themes, whereas boys had significantly stronger interests in programs with male oriented themes (Johnsen and Swoope, 1987).

The importance of these findings is that interest in the computer can be affected by altering the "sexual orientation" of the associated software. This reinforces the idea that socialization and environmental factors can have a strong influence on who uses computers.

In the area of higher education, a study conducted in graduate psychology and education classes at the University of Toronto investigated gender difference in computer attitudes, literacy and commitment. The mean age for students in this sample was 27.2 years, and the break down of males to females were 33% and 67% respectively. Students in this survey group were teachers representing all grade levels.

Students were told to answer questions in the areas of: 1) Total commitment towards computers (which included interest in computers, promotion of computers, and use of computers); 2) Total attitudes (which included cognitive and affective attitudes); and 3) Total Computer Literacy (which included basic skills, application software, computer awareness, programming, and computer experience). Responses to questions in each of these categories were tabulated and statistically compared between males and females. It was found that there were significant differences between the groups in total commitment and total computer literacy. The study, however, found no difference between males and females in terms of overall attitudes (both cognitive and affective) (Kay, 1989, p. 313).

Commitment towards the use of computers was suggested as being tied to overall knowledge (literacy). The possibility is that the more proficient someone is in using a computer, the more likely he/she will be committed towards using it in the future (Kay, 1989, p. 314).

This idea has some serious implications. Although females may have positive attitudes towards computers, they may be less inclined to use and pursue the study of them due to a relative lack of proficiency. Increased computer literacy may increase overall perceptions in locus of control and commitment. However, "A certain degree of commitment to computers will be required before female teachers will take time out of their already busy schedules to actively acquire computer literacy skills." (Kay, 1989, p. 314). It seems that females must be actively encouraged and supported with regard to the use of the computer and the pursuit of more advanced computer skills.

Summary

Mathematical differences between the sexes have been clearly documented in many different research articles. It seems that males dominate the field by significant margins, and that discrepancies in performance increase in the upper levels of mathematical reasoning. Differences in mathematical enrollments become pronounced that e secondary level, and even more so in higher education. The most obvious effect of these differences is represented in the disparity between males and females in selecting mathematically oriented careers.

Scientific careers--including computer science, are strongly correlated with mathematical ability. These occupations have been traditionally stereotyped as male oriented. Environmental pressures and conditioning seem to be very important factors in the formation of these individual perceptions and career goals.

Studies have shown that males and females do not differ significantly in attitudes towards computer use (this seems to be true at all levels--from primary ages through graduate school). They do reveal that factors such as the theme of a computer program, and proficiency in computer use can affect the willingness to use the computer. It has therefore been suggested that educational themes that are not sexually biased be presented to computer students, and that the encouragement of females be promoted as much as possible with regard to computer use.

Studies also show that there is clear bias in computer journals with respect to gender and racial background, with white males significantly over-represented, and females and ethnic minorities under-represented. It is suggested that these biases may reinforce stereotypes that exist within society with regard to computer use, and that they may widen the gap, between white males and the under-represented groups if steps are not taken to rectify the problem.

Objectives

This study was designed to provide information on the general attitudes of teachers towards computer use. Specifically, it has tried to determine if there are differences in attitudes towards computer use between male and female teacher candidates. The questionnaire used in this study had several items pertaining to attitudes. It also had questions which were designed to determine the depth of the students' computer and mathematical backgrounds. The initial hypothesis was that subjects with strong mathem..ical backgrounds and/or large amounts of experience using the computer would have attitudes that were more favorable towards computer use. Because educational research has indicated that there are differences between males and females in the area of mathematical expertise and computer usage, it became the focus of this study to determine if these same discrepancies applied to education students as well.

A secondary focus of this study was to determine the perceived importance of different topics within an introductory computer course. The question of relevance is one that is often raised in the realm of computer courses, and there are few studies which have documented the opinions of students in regard to these various topic areas. At the college level, student input is certainly important in helping to determine the structure and curriculum content of courses. Results of this study might be used as a guide in helping to design future frameworks for introductory computer curriculums.

Methods

Instructors in the educational computer technology program at Cal Poly, Pomona, were asked to allow their students to complete a questionnaire pertaining to micro-computer use. Students were informed that their participation in the study was voluntary, but would be greatly appreciated. They were also told that the information obtained from this study would be used as one of the guidelines for helping to improve the Educational Computer Technology Program. Every section of the class that was offered during the quarter was surveyed.

The survey contained three types of questions. The first category was designed to help assess the backgrounds of students in the areas of mathematical preparation and computer experiences. The questions in this section were as follows:

1) How many math courses did you complete in high school?;

2) How many math courses did you complete in college?;

3) Have you used the computer before?;

4) Do you use the computer regularly for word processing?;

5) Do you use the computer regularly for spread sheets?;

6) Do you use the computer regularly for data-bases?;

7) Do you own a personal computer?;

8) Do you program the computer regularly?;

9) How many years have you used the computer?;

10) How many computer languages do you know?

These questions provided both nominal and interval level data.

The second part of the survey contained questions designed to determine attitudes towards computer use. The questions in this section were tied to a 4 point Likert Scale where: (4) = Strongly Agree; (3) = Agree; (2) = Disagree; and (1) = Strongly Disagree. In this section, students were asked:

1) If they plan on using the computer in their classrooms;

2) If they were comfortable using the computer;

3) How interested they were in taking other computer courses;

4) If they believe that instructional software is of high quality;

5) If they felt that school districts allocate sufficient funds for computer programs;

6) If they believed the computer was beneficial to school age children;

7) If they believe the computer was important to primary (K-6) teachers;

8) If they believed the computer was important to intermediate (7-8) teachers;

9) If they believe the computer is important to high school teachers;

10) If they believe teachers should be required to know how to write instructional software;

11) If they believed that teachers should have basic computer literacy skills.

Students were also asked about the topics they felt were important and relevant to their use of the computer as classroom teachers. Ordinal data was again provided in this area, using the same 4 point Likert scale. In this section, teachers were asked if they would be interested in learning: a) Wordprocessing; b) spreadsheets for the purpose of maintaining gradebooks; c) database programs for the purpose of keeping records on students; d) telecommunications as it applies to education; e) use of instructional software packages in their subject areas; f) programming using computer languages; g) the history of computing; and f) the latest uses of technology in the classroom. Appendix I has a copy of the questionnaire that was used in this study.

Male and female subjects were compared in the areas of computer backgrounds, attitudes, and subject interests. Nominal level data was compared using chi-square analysis. The comparisons on ordinal and interval level variables were accomplished using t-test. Results of this study appear in the following section.

Results

A total of 92 students (N=92) responded to the questionnaire overall. Of these, 78% were female, and 12 % male. Primary teachers (K-6) represented 37% of this group; middle school teachers (7-8) represented 13.7%; high school teachers (9-12) represented 26%, and higher education, 5.5%. 17.8% of the students surveyed were not yet teaching, but had tendencies towards primary grades.

In the area of education, the breakdown was as follows:

Table 1: Level of Education

Students with a BA/BS degree	79.5%
Students with an MA/MS degree	19.2%
Students beyond Master's	1.4%.

Because all students wishing to obtain a teaching credential are required to pass a computer literacy course, these classes tend to have students that are from all specialty fields within the school of education. From this standpoint, it can be surmised that a fairly representative cross-section of education students was obtained.

Ages of the students were as follows:

Table 2: Age

23 - 30	54.8%
31 - 40	32.9%
41 - 50	11.0%
50+	1%

On measures of experience, it appears that the majority of students in this survey had used the computer at some time in the past (89% who did vs. 11% who did not). In terms of using the computer regularly for any purposes, this results indicated that the majority of students were not regular computer users.

Table 3: Measures of Experience (Nominal)

Question	*Yes*	*No*
1	89.0	11.0
2	46.6	53.4
3	9.7	90.3
4	8.2	91.8
5	32.9	67.1
6	4.1	95.8

1--I have used the computer before
2--I use a computer regularly for word processing
3--I use a computer regularly for spreadsheets
4--I use a computer regularly for data bases
5--I own a personal computer
6--I program the computer regularly

In terms of mathematical preparation and computer background, this study showed that the typical student had completed about 3 courses of mathematics in college, 1 computer course, and three years of high school math. The typical student had about two years of exposure to computer use (although not necessarily frequent use as indicated in the previous data), and had some knowledge of programming languages (see table 4). Overall, it appears as though the mathematical and computer backgrounds of the students in this program were extremely limited.

Table 4: Mathematical and computer backgrounds (Interval).

Question	Mean	Median	Mode	Std. Dev	Std. Err
I	2.73	3.00	2.00	1.36	0.16
II	1.25	1.00	1.00	1.08	0.13
III	3.36	3.00	4.00	1.03	0.12
IV	2.25	2.00	0.00	2.02	0.24
V	0.96	1.00	0.00	1.34	0.16

I--Number of math courses taken in college
II--No. of computer courses taken overall
III--No. of math courses completed in high school
IV--No. of years using the computer
V--No. of computer languages that you know

On attitudinal measures, it is interesting to note that most of the teachers and teacher candidates planned on using the computer in their classrooms, and that the majority of these individuals felt relatively confident in using the computer--even with their limited backgrounds. Most teachers believe that the computer is important at all grade levels, although the data suggest that the computer is perceived as most useful to high school teachers, and somewhat less useful to middle school and primary teachers. Teachers did not feel that they should know how to maintain and repair computers. Most are interested in pursuing other courses in computer education. Most teachers also believed that quality educational software exists, but that school districts do not allocate sufficient funds to purchase such software or the equipment to use it. Most of the teachers sampled strongly believed that computerized instruction was beneficial to students, and that the computer is becoming a ubiquitous fixture in today's classrooms. It is interesting to note that even with these beliefs, that these teachers did not feel that the computer was playing an important instructional role currently (see table 5).

Table 5: Measures of Attitude

Question	Mean	Median	Mode	Std. Dev.	Std. Err
A	3.44	4.00	4.00	0.69	0.08
B	3.40	3.00	4.00	0.68	0.08
C	2.32	2.00	2.00	0.85	0.10
D	3.10	3.00	3.00	0.72	0.84
E	2.25	2.00	2.00	1.80	0.21
F	3.37	3.00	3.00	1.89	0.22
G	3.51	3.00	3.00	1.31	0.15
H	3.36	3.00	3.00	0.48	0.06
I	3.47	4.00	4.00	0.60	0.07
J	3.53	4.00	4.00	0.53	0.06
K	3.00	3.00	3.00	0.95	0.14
L	2.99	3.00	3.00	0.95	0.11
M	2.69	2.00	2.00	1.33	0.16

A--I plan on using educational software packages in my classroom.
B--I feel very comfortable with the idea of using the computer.
C--Teachers should know how to repair and maintain computers.
D--I am interested in taking other computer courses.
E--The quality of instructional software and availability is not great enough to make the computer an effective tool.
F--School districts do not allocate sufficient funds to make the use of the computer worthwhile.
G--Computer assisted instruction is becoming more beneficial to primary (K-6) teachers.
H--The computer is important to primary (K-6) teachers.
I--The computer is important to intermediate (7-8) teachers.
J--The computer is important to secondary (9 - 12) teachers.
K--The computer is becoming more integrated in the classroom in all subject areas.
L--The computer is becoming more integrated in the classroom at all grade levels.
M--The computer plays an important instructional role in most classrooms today.

In the area of curriculum content (what teachers feel should be taught in a fundamental computer course), most teachers believed that it was important to: 1) Have basic literacy skills; 2) Know how to use a word processor; 3) Know how to use a spreadsheet; 4) Know how to use a database; 5) Be taught about telecommunications in education; 6) Be taught how to use instructional software in their fields of specialty; 7) Know how to program the computer; 8) Be taught about the history of computing; and 9) Be taught about the latest uses of technology in the classroom.

Teachers did not feel that they should be required to know how to write an instructional software package. Part of this stems from the fact that these teachers believed that ten weeks was not a sufficient amount of time to learn how to write a package as effective as a commercial one. It should be noted that teachers were less interested in programming and history when compared to other aspects of computer curriculum (See table 6).

In comparing males and females, significant differences were found to exist on two nominal measures of experienced (as revealed by Chi-Square analyses). These were in the areas of: 1) Having used the computer before; and 2) Using the computer regularly for word processing. The data indicated that *females* scored significantly higher on these two measures (see table 7). No significant differences were found to exist between males and females on interval measures of mathematical and computer backgrounds. With regard to measures of attitude, males and females did not seem to differ significantly except on one measure, which was the interest in pursuing further computer education. Males appeared to be significantly more interested than their female counterparts in this area (0.004 significance level--refer to table 8). Finally, in the category of topic interests, males and females appeared to be in general agreement. There was one difference in the area of history of computing. Males indicated a stronger interest in the history of computing when compared to females (0.025 significance level)--(See table 9).

Table 6--Topic Areas Teachers Feel Should be Emphasized

Questions	Mean	Median	Mode	Std. Dev.	Std. Err
N	2.34	2.00	2.00	1.43	0.17
O	3.29	3.00	3.00	0.49	0.06
P	3.30	3.00	3.00	0.62	0.07
Q	3.33	3.00	3.00	0.93	0.11
R	3.32	3.00	3.00	1.35	0.16
S	3.23	3.00	3.00	1.16	0.14
T	3.52	3.00	3.00	1.09	0.13
U	2.84	3.00	3.00	1.49	0.17
V	2.90	3.00	3.00	1.46	0.17
W	3.45	3.00	3.00	1.09	0.13

N--Teachers should be required to know how to write instructional software.
O--Teachers should have basic computer literacy skills.
P--Teachers should be taught how to use word processing packages.
Q--Teachers should be taught how to use spreadsheet packages to help maintain gradebooks.
R--Teachers should be taught how to use database programs to help keep records on individual students.
S--Teachers should be taught about the uses of telecommunications in education.
T--Teachers should be taught how to use instructional software packages in their subject areas.
U--Teachers should be taught how to program the computer using computer languages.
V--The history of computing is an important aspect of any computer curriculum.
W--Teachers should be taught about the latest uses of technology in the classroom.

Table 7: Chi Square Analysis

Question	Chi Sq.	Significance	Cramer's V
1	8.86	<0.01	0.34
2	6.38	0.01	0.30
3	0.28	0.60	0.06
4	0.50	0.48	0.08
5	0.58	0.45	0.09
6	1.57	0.21	0.23

1 --Have you used a computer before?
2--Do you use the computer regularly for word processing?
3--Do you use the computer regularly for spreadsheets?
4--Do you use the computer regularly for databases?
5--Do you own a personal computer?
6--Do you program the computer regularly?

Table 8: T-test data (mathematical backgrounds)

Question	t Value	Df	2 tail prob.
I	0.49	91	0.62
II	0.28	91	0.78
III	0.08	91	0.94
IV	-0.27	91	0.79
V	1.42	91	0.16

Table 9: T-test data (measures of attitude)

Question	t Value	Df	2 tail prob.
A	-0.27	88	0.79
B	0.68	91	0.50
C	1.33	91	0.19
D	1.79	90	0.08
E	2.99	91	<.01
F	0.76	91	0.45
G	-0.02	91	0.98
H	-0.41	91	0.69
I	-1.15	91	0.25
J	-0.29	91	0.77
K	0.00	91	1.00
L	-1.13	91	0.26
M	-1.05	91	0.30

Table 10: T-test data (topic areas teachers feel should be emphasized)

Question	t Value	Df	2 tail prob.
N	1.50	91	0.14
O	0.81	91	0.42
P	-1.30	91	0.20
Q	-1.94	91	0.06
R	1.04	91	0.30
S	1.04	91	0.30
T	0.95	91	0.35
U	1.46	91	0.15
V	2.29	91	0.03
W	2.67	91	0.33

Discussion

Contrary to the initial hypotheses of this study, there appeared to be no significant differences in overall measures of background, attitude, and topic interest between males and females. This study revealed that on measures of background, females actually had slightly better computer backgrounds than their male counterparts. In the area of attitude, only one measure indicated any significant differences: The quality of instructional software and availability is not great enough to make the computer an effective tool. Males and females differed significantly on this measure as revealed by t-test analysis (the 2 tail probability level was less than 0.01). However, because the only major difference is in this category, there is the possibility that this could be a type I error. The information obtained by this study contrasting sex differences seems to be opposite to findings obtained by other researchers. Such information can be viewed as encouraging.

One conclusion that might be drawn is that the "gap" between males and females in the area of computer education is not as wide as it has been in the past. If other studies revealed similar results to this one, this conclusion might be construed as viable. A more likely conclusion, however, is that these data reflect a skewed sample. It should be mentioned that the "average" male does not enter the teaching profession. The majority of males appear to enter fields like engineering, business, and the sciences. Therefore, the relatively small percentage of men who enter the teaching profession do not reflect the mathematical or scientific backgrounds attained by the more "typical" college male.

On the issue of attitude, it should be mentioned that other studies have revealed positive orientations towards computer use for both males and females. The data in this study has tended to support this general finding. What is most noteworthy is the fact that there seemed to be a strong interest in using the computer in individual classroom settings. With this in mind, it may be possible to "nurture" this interest by providing course work that emphasizes the integration of the computer into daily curriculum--something which teachers should perceive as useful.

It would also seem reasonable to promote extended computer instruction to both males and females in education. Since both male and female teachers tended to lack computer experience, and because there was a willingness (as reflected in this study) to pursue further coursework, it would probably be advantageous to promote and nurture this interest by providing encouragement, positive feedback, and curriculum that is practical.

Finally, on the issue of computer curriculum perceptions, teachers appeared to be interested in learning about applications that would allow them to manage their classrooms, and in applications which would allow them to use the computer as a teaching tool or supplement (both Computer Managed Instruction (CMI) and Computer Assisted Instruction (CAI). Areas which were perceived as less important were topics such as programming, the history of computing, and computer maintenance. Again, it appears that practical application is the guiding force affecting opinions in this area. It seems prudent to use teacher student perceptions and opinions as part of the criteria for establishing curricula--especially in a profession as dynamic as teaching. However, it would be a mistake to let student perceptions and desires control the curriculum entirely, as there are many new developments in the computer field which are largely unknown the general student population.

The results of this study provide an interesting insight into the sex differences between teacher backgrounds and attitudes Differences between the sexes is not as wide among teachers as might have been expected from the analysis of other groups. Further study in this area would provide valuable information about these topics, which are becoming increasingly important in education.

Bibliography

Astin, A.W., (1987). The American freshman: twenty year trends, Los Angeles, CA, Cooperative Institutional Research Program.

Benbow, C.P., and Stanley, J.C., (1983). Sex differences in mathematical reasoning ability, Science, 222, 1029 - 1031.

Binswanger, R., (1988). Discovering perimeter and area with Logo, Arithmetic Teacher, 35, 18 - 24.

Bitter, G.G., (1984). Computers in today's world. New York: John Wiley & Sons.

Bitter, G.G., and Hatfield, M.M., (1989). Computing and mathematics, Journal of Reading, Writing, and Learning Disabilities, 5, 1 - 21.

Cohen, A.L., (1988). Improving speed and accuracy of word recognition in reading disabled children: an evaluation of two computer program variations, Learning Disability Quarterly, 8, 333 - 340.

Gross, B., (1989). Can computer assisted instruction solve the dropout problem? Educational Leadership, 46, 49 - 51.

Hurwitz, D., (1985). Computers in gyms: friends and assistants. Paper presented at the annual educational computer fair of the educational computer consortium of Ohio (5th, Cleveland, OH, October 10 -11, 1985).

Johnson, C.S., and Swoope, K.F., (1987). Boys' and girls' interest in using computers: implications for the classroom, Arithmetic Teacher, 35, 14 - 16.

Kay, R.H., (1989). Gender differences in computer attitudes, literacy, locus of control, and commitment, Journal of Research on Computing in Education, 21, 307 - 317.

Kelly, L.E., (1987). Computer management of student performance, Journal of Physical Education, Recreation, and Dance, 58, 12 - 20.

Kiesler, S., Sproull, L., and Eccles, J.S., (1983). Second class citizens?, Psychology Today, 41 - 48.

MacArthur, C.A., and Graham, S., (1987). Learning disabled students' composing under three methods of text production: handwriting, word processing, and dictation, Journal of Special Education, 21, 22 - 42.

Maccoby, E.E., and Jacklin, C.N., (1974). The psychology of sex differences, Stanford, CA: Stanford University Press.

Malouf, D.B., (1987-88). The effect of instructional computer games on continuing student motivation, Journal of Special Education, 21, 27 - 38.

Marshall, J.C., and Bannon, S., (1988). Race and sex equity in computer advertising, Journal of research on computing in education, 21, 15 - 27.

McKeown, P., (1988). Living with computers, New York: Harcourt Brace Jovanovich.

Meese, J.L., and Parsons, J.E., (1982). Sex differences in math achievement: toward a model of academic choice, Psychological Bulletin, 91, 324 - 348.

Swick, K.S., (1989). Appropriate uses of computers with young children, Educational Technology, 29, 7 - 13.

Priest, S., (1987). Teaching microcomputer applications in physical education, Journal of Physical Education, Recreation and Dance, 58, 18 - 20.